



METROLINK

Positive Train Control Implementation in the LA Basin

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National Railroad Construction
and Maintenance Association

PTC Overview

- Positive Train Control is a predictive collision avoidance system that provides a warning to train operators and then intervenes and stops a train before a collision or other hazardous train movement can occur.
- Small In-House Team on Special Assignment -Since Nov. 2008
- Consultant Support Teams Mobilized -January 2009
- Large Turnkey (Vendor/Integrator) Parsons with Wabtec /ARINC as key suppliers awarded Oct. 2010.
- I-ETMS will be deployed.
- SCRRA PTC in-service summer 2013.

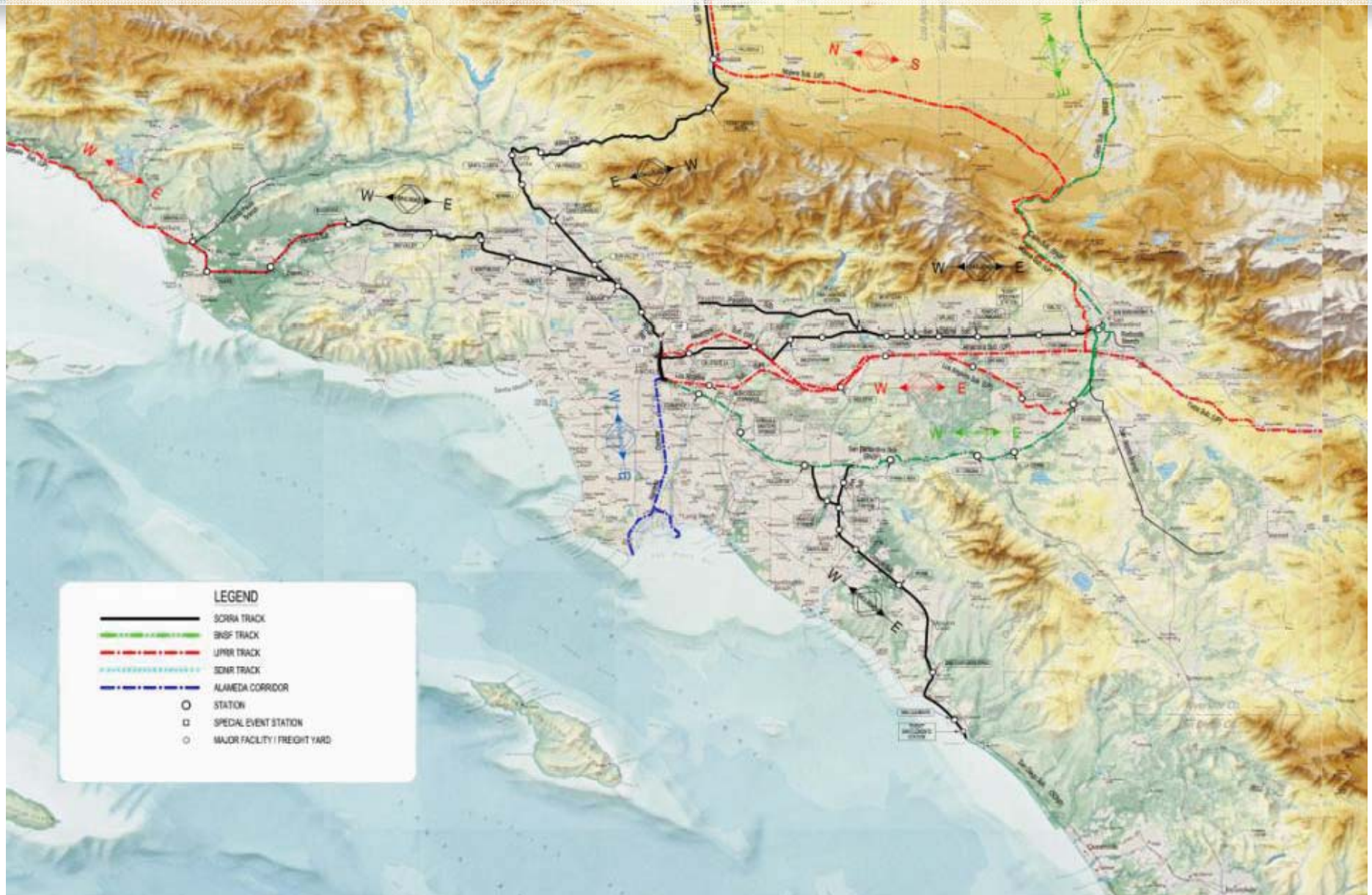


Metrolink Key Characteristics

- 7 Routes, 55 Stations, 45,000 average daily riders
- 227 Route miles maintained. Another 348 miles shared.
- 324 Track miles maintained. 180/150 double/single track.
- 162 Weekday Revenue Passenger Trains
- 500 + Daily train movements - Metrolink, Amtrak, UP, BNSF
- 52 Locomotives, 180 Passenger Coach Cars
- Operating Budget \$179.4 million.



Southern California Rail Network



Train Control and Signal System

- 102 Control Points
- 90 intermediate signal locations
- 461 at-grade crossings- vehicle and pedestrian
- 5 County Southern California communication network
 - Leased commercial telco. services – MPLS, copper.
 - Migrating to Metrolink owned fiber, digital microwave
 - VHF/Voice 160 MHz Voice, 900 MHz ATCS
- Method of Operation – Centralized Traffic Control w/ ATS
- Computer Aided Dispatch (CAD) –Digicon (unsupported)



LA Basin PTC Unique Characteristics

- BNSF/UPRR/Amtrak/Coaster Interoperability
- Dense mixed passenger and freight territories
- Numerous inter-railroad movements
- Complex multiple main tracks
- 2.2%+ mountain grades in dense urban setting
- High use of wireless communication systems
- Commitment for expedited PTC delivery



SCRRA PTC - Project Execution Approach

- Early-on special long term assignment of dedicated SCRRA staff to deliver the combined program
- Utilize multiple on-call consultants/contactors for support
- Study, learn and apply Class 1 Freight's PTC technology and implementation approach (I-ETMS).
- Consolidate as much work as possible with single contractor- a Vendor/Integrator to assure accountability for systems integration.
- Develop and implement PTC training and transition plan.



SCRRA PTC – Owner's Role

1. Perform initial assessments, scoping, cost estimates
2. Develop FRA PTC Implementation Plan
3. Develop V/I RFP and manage the solicitation process
4. Develop mapping/track data base
5. Harden and expand the backhaul comm. network
6. Procure 220 MHz spectrum
7. Install WIU's
8. Secure grant funds.
9. Program Manager
10. Coordinate Projects



SCRRA PTC - Vendor Integrator's (V/I) Role

1. PTC system development, engineering, integration
2. Modify or add PTC new assets- test, place in-service
 - Provide new computer aided train dispatch system with full PTC compatibility
 - Provide PTC Back Office Systems/Server (BOS)
 - Install on-board equipment in locomotives & cab cars
 - Install 350 PTC radios at signals and CP's, locomotive and cab cars base stations.
 - Provide PTC communication system
 - Provide Network Management System
3. Perform training of all SCRRA staff & contractors
4. Provide spare part and warranties

Major Project Risks Identified Early On

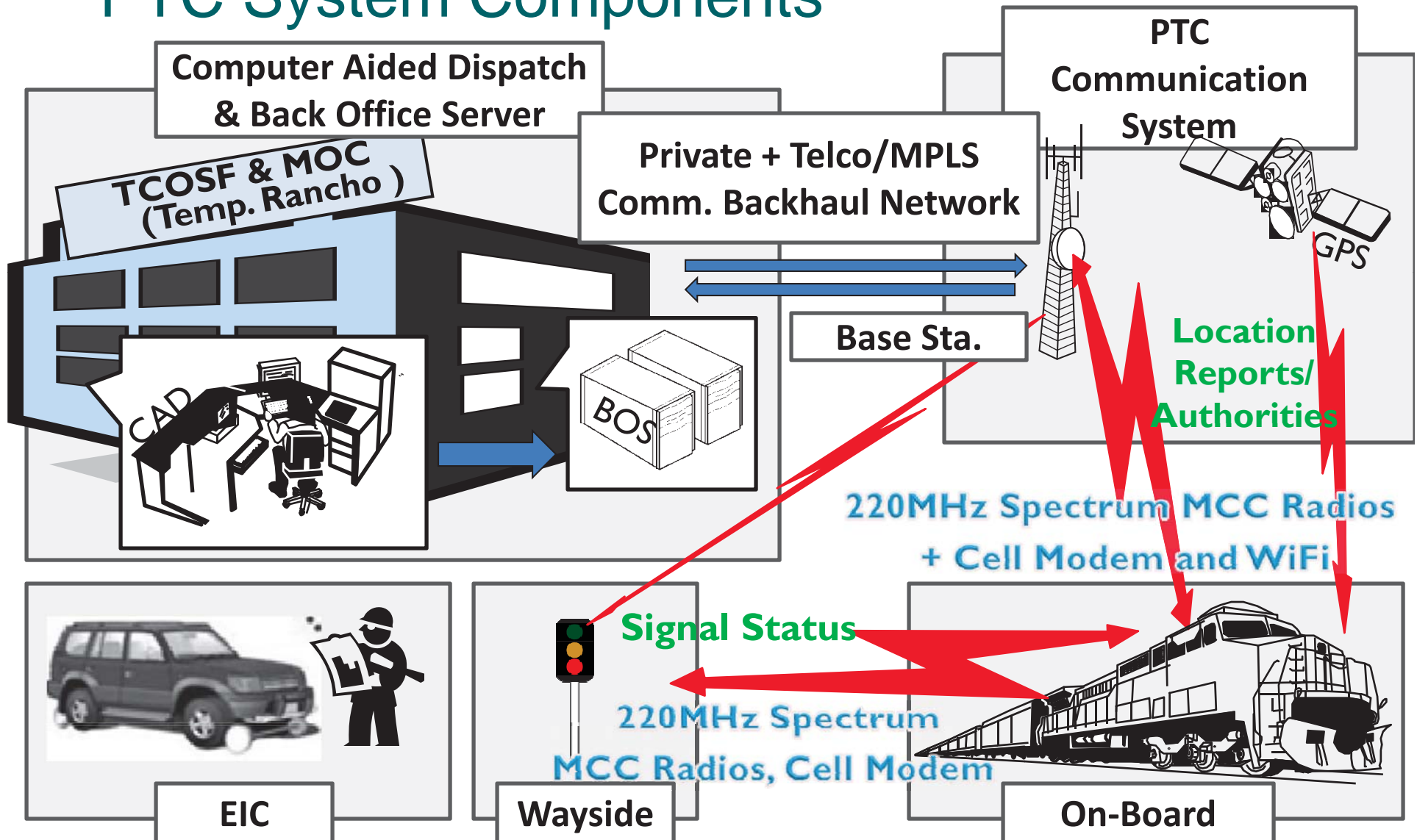
1. Schedule compression - catching up to the same level of expertise as BNSF & UP.
2. Competition for specialized technical resources.
3. Assembling and organizing the owner's team with the right mix of experience and expertise.
4. Procuring a qualified Prime Contractor/Vendor with Federal, State, local public procurement requirements.
5. Funding - both amount and timing
6. Interoperability (ITC standards availability)



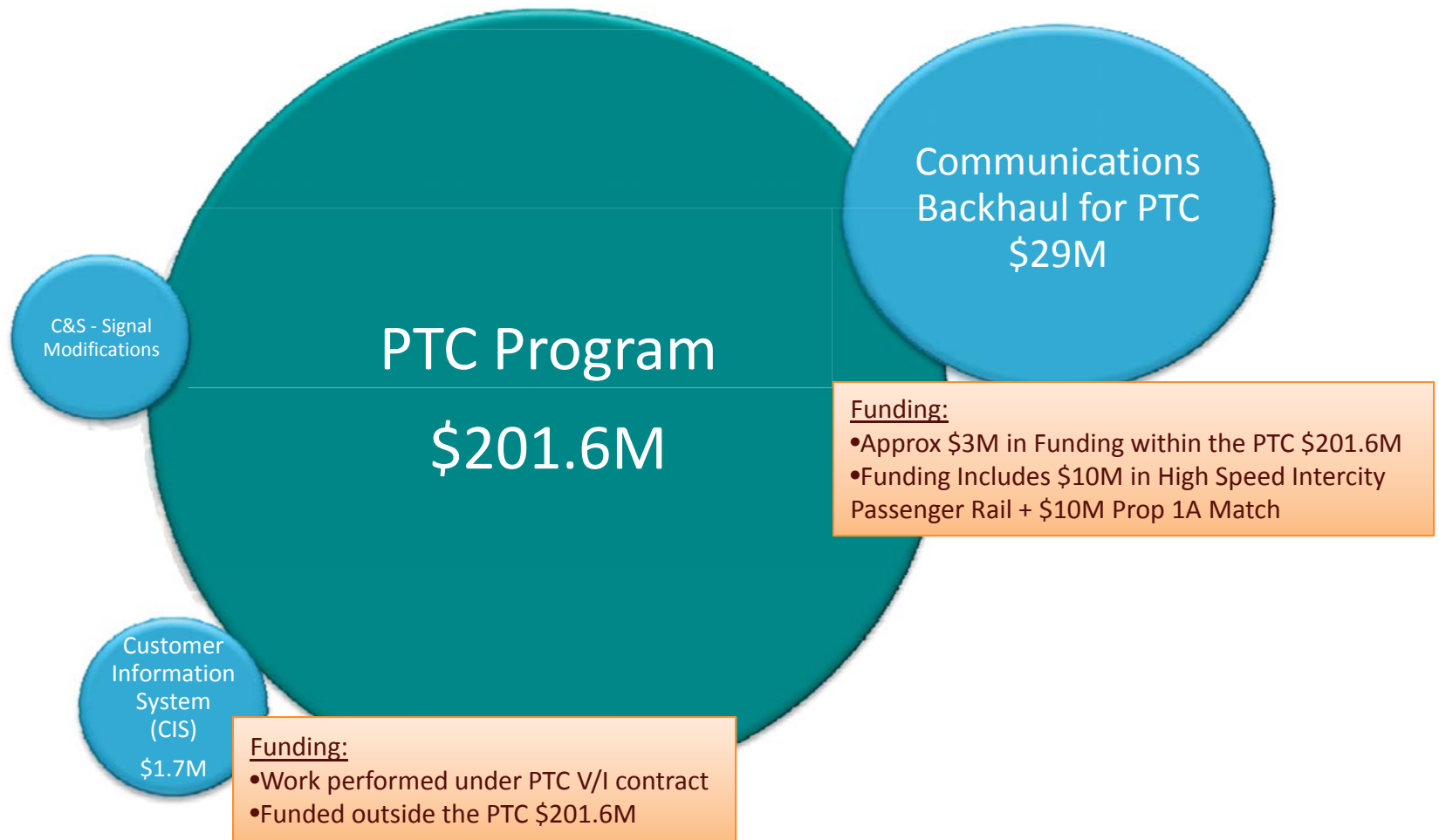
PTC System Major Components and Suppliers

- Computer-Aided Dispatch (CAD) – ARINC
 - Current CAD system is unsupported and cannot be upgraded for PTC compatibility.
- Back Office Server (BOS – ITC system similar to UP, CSX, NS) – *Wabtec/ARINC*
 - Links PTC to CAD. BOS contains the safety critical infrastructure database.
- Communication System – *ARINC/MeteorComm, Lilee/G4S/Parcomm*
 - Delivers PTC messages and commands between the BOS, the wayside signal system and the locomotive using 220-MHz network architecture.
 - This safety system requires a reliable communication backhaul network which will be implemented outside of the core PTC program.
 - Sufficient quantity of 220-MHz wireless spectrum must be acquired and licensed.
- On-Board – *Wabtec*
 - Locomotive-centric system contains the track map, braking algorithm, mandatory directives and restriction information.
- Wayside – *ITC, General Electric, Lilee, Mass Electric*
 - Overlay on the existing wayside signal system. Wayside signals beacon their status to approaching trains.
- Systems Integration - Parsons
 - Lab and field testing, integrating the different systems, training.

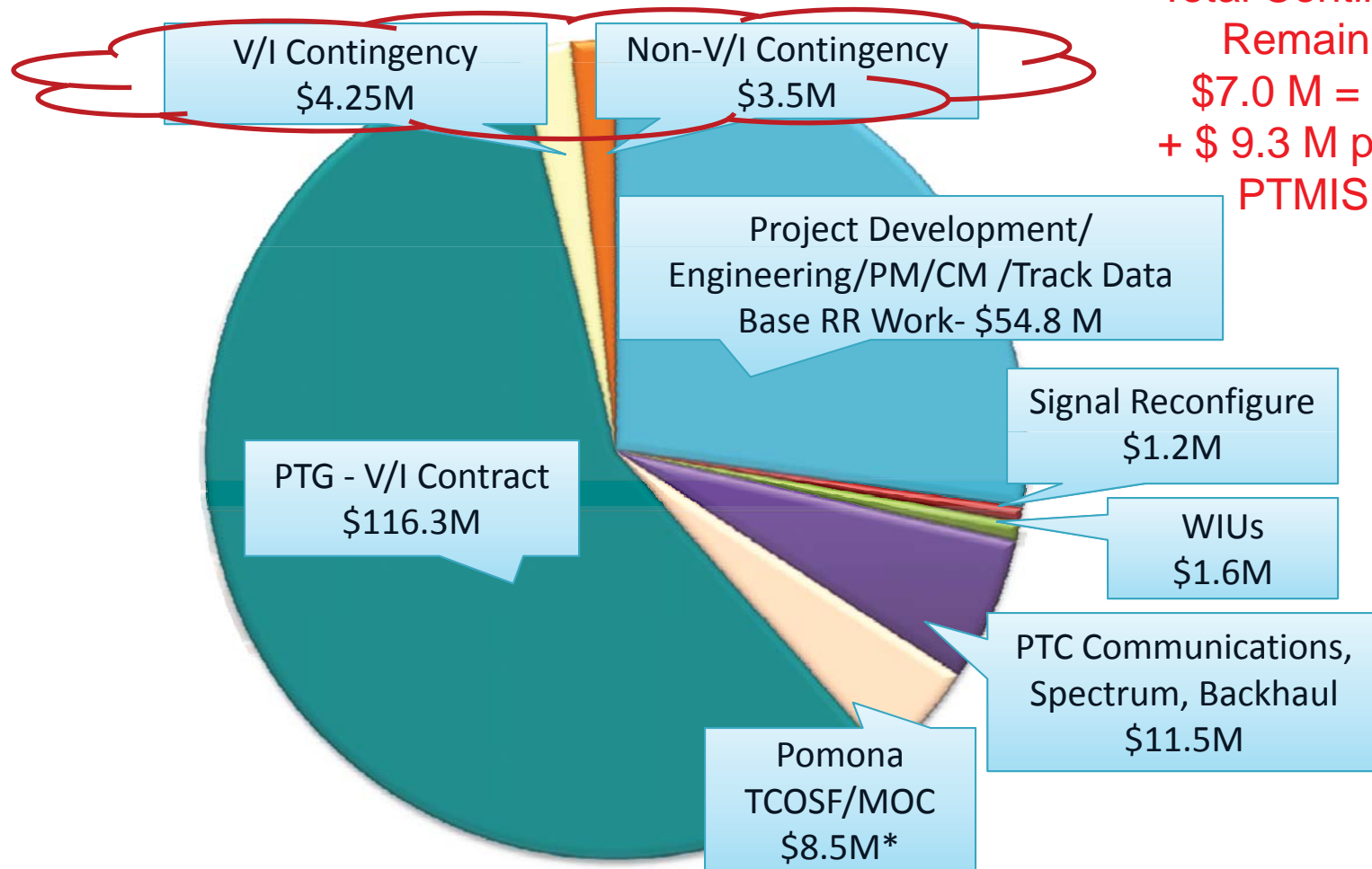
PTC System Components



PTC and Interdependent Programs



PTC Program Budget - \$201.6M +



Total Contingency Remaining:
\$7.0 M = 4.6%
+ \$ 9.3 M pending PTMISEA

*Additional \$4-5M from PTMISEA anticipated for Pomona TCOSF/MOC

PTC Program Budget – 29% Expended

Project Element / Task	Budget	Expended (Nov 2011)
Project Develop, Engineering, Track Data Base - PM/CM	54,295,380	29,079,955
Relocate/Reconfigure Signals	1,181,738	228,800
WIUs, C&S, Track Modification	1,577,628	1,544,616
PTC Communications, Wireless & Backhaul	11,507,800	912,685
Acquire PTC 220 Radio Spectrum from MCLMC	7,178,000	657,800
PTC Contribution to Overall Comm. Back-haul Program	4,329,800	254,885
RR Work Orders/Coordination	500,000	807
Pomona TCOSF/MOC	8,553,751*	861,523
Vendor/Integrator	116,918,018	25,100,523
On Board Component	21,745,067	2,186,527
Communications Component	12,817,839	2,642,878
Wayside Communications Component	22,819,233	6,026,622
Back Office Component	5,866,910	877,000
Dispatch System	6,276,394	2,135,745
Integrated System	9396994	-
Contract Documentation	5,502,301	1,011,702
Hi-Rail Test Vehicles	462,336	462,336
Project Eng., PM, Support Tasks, Facilities & Hi-rails	24,680,444	8,442,706
Commercial Terms (Bonds, Insurance) & Taxes	7,350,500	1,315,007
Remaining V/I Contingency and Options	3,598,454	**
Remaining Non-V/I Contingency	3,500,000	-
Project Totals	201,632,769	49,872,380

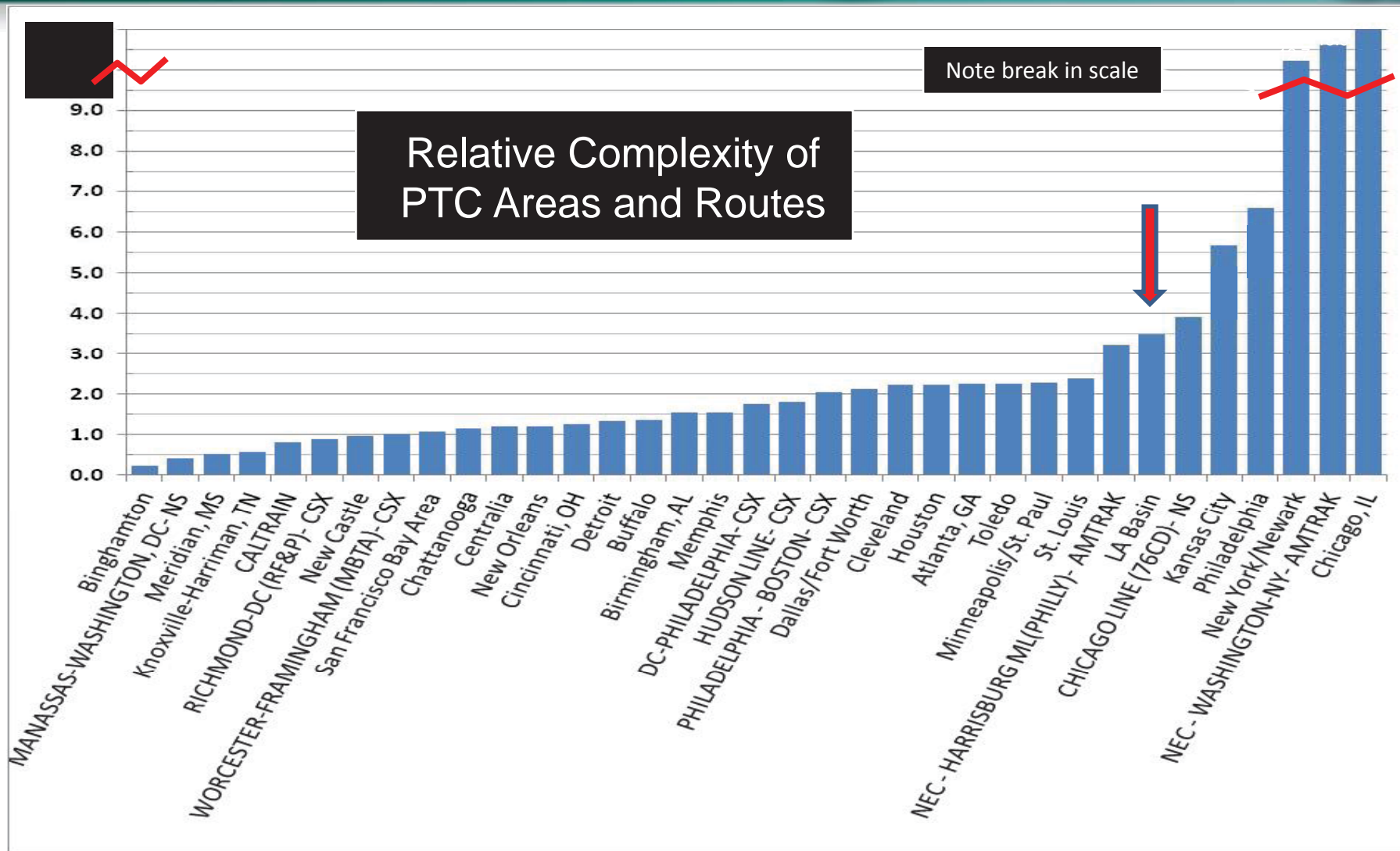
Delivering and Coordinating the SCRRA PTC C&S Backlog!

Next 3-Years (in millions of dollars)

Program Category	FY 11/12	FY 12/13	FY 13/14	Total
Positive Train Control	50	60	40	150
Orange County Comm. Network	12	5	0	17
Valley/Ventura/ San Gabriel Network	15	15	5	35
Completing Orange County MSEP/OCX	10	2	0	12
Capital Rehabilitation and new Capital Projects	10	10	10	30
Signal and Comm. Maintenance	12	12	13	37
Third Party Support Projects	10	10	10	30
Total Annual PTC C&S Program Costs	119	114	78	311

PTC Program Funding – 33+ Separate Grants!

Secured Funds	Fund Type	\$ 201,632,769
Local	MTA Local	\$ 3,310,587
Local Match to Federal Formula Funds	RCTC/OCTA/SBAG	\$ 157,824
MTA Measure R FY10/11 & FY11/12	MTA local	\$ 20,000,000
State STIP	State	\$ 125,293
Prop 1B - TSGP (SCRRA, VCTC)	State	\$ 12,953,285
Prop 1B - PTMISEA (SCRRA)	State	\$ 7,871,319
Prop 1B - FY 10/11 & FY 11/12 SLPP	State	\$ 20,000,000
Prop 1A - Intercity to SCRRA	State	\$ 46,550,000
Prop 1A - SCRRA	State	\$ 12,200,000
Prop 116 - OCTA	State	\$ 32,715,778
National Railroad/ State	State	\$ 9,855
OCTA FTA Sec 5307	FTA - OCTA	\$ 4,147,427
ARRA Formula	FTA ARRA	\$ 17,825,530
Federal formula Funds	FTA	\$ 631,296
Federal Rail Research and Development Funds (SCRRA)	FRA	\$ 487,000
FRA Technology Grant SCRRA	FRA	\$ 6,605,446
Prop 1A SCRRA	State	\$ 12,542,129
FRA High Speed Intercity Passenger Rail (HSIPR)	FRA - Caltrans	\$ 3,500,000
Programmed Funds		\$ 9,301,415
PTMISEA FY10/11 (Contingency)	State	\$ 9,301,415
Total		\$ 210,934,184



Interoperable ROUTES shown in all CAPITAL LETTERS

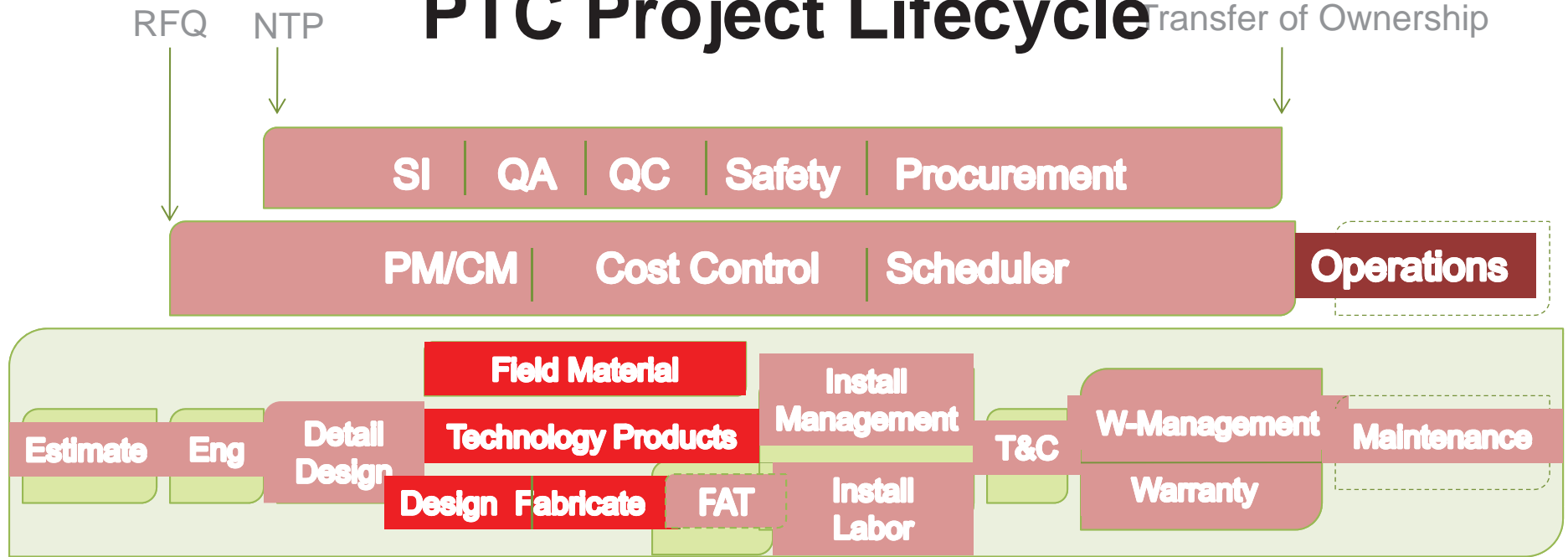
Metrolink PTC In Service Summer 2013

What does that mean?

- Cab Cars & Locomotives PTC-equipped
- SCRRA wayside signals PTC equipped
- BOS is functioning
- Essential Comm. Network complete. MPLS links in.
- Extensive lab, field, testing with trains completed
- Integration testing and validation completed.
- FRA certification of PTC Safety Plan
- PTC operating rule changes in effect
- Operations & Maintenance personnel trained

PTC Project Lifecycle

Transfer of Ownership



Metrolink

Parsons

Wabtec

Parsons Perspective of Project

- Lump Sum Bid
- Undeveloped Technology/ Unpublished ITC Standards
- Third Party Stakeholders- UPRR, BNSF, FRA...
- Expedited Schedule
- Vendor Resources Stretched to meet 12/2015 industry mandate
- First-time System-wide implementation
- Commitment of 20 Dedicated Staff for duration

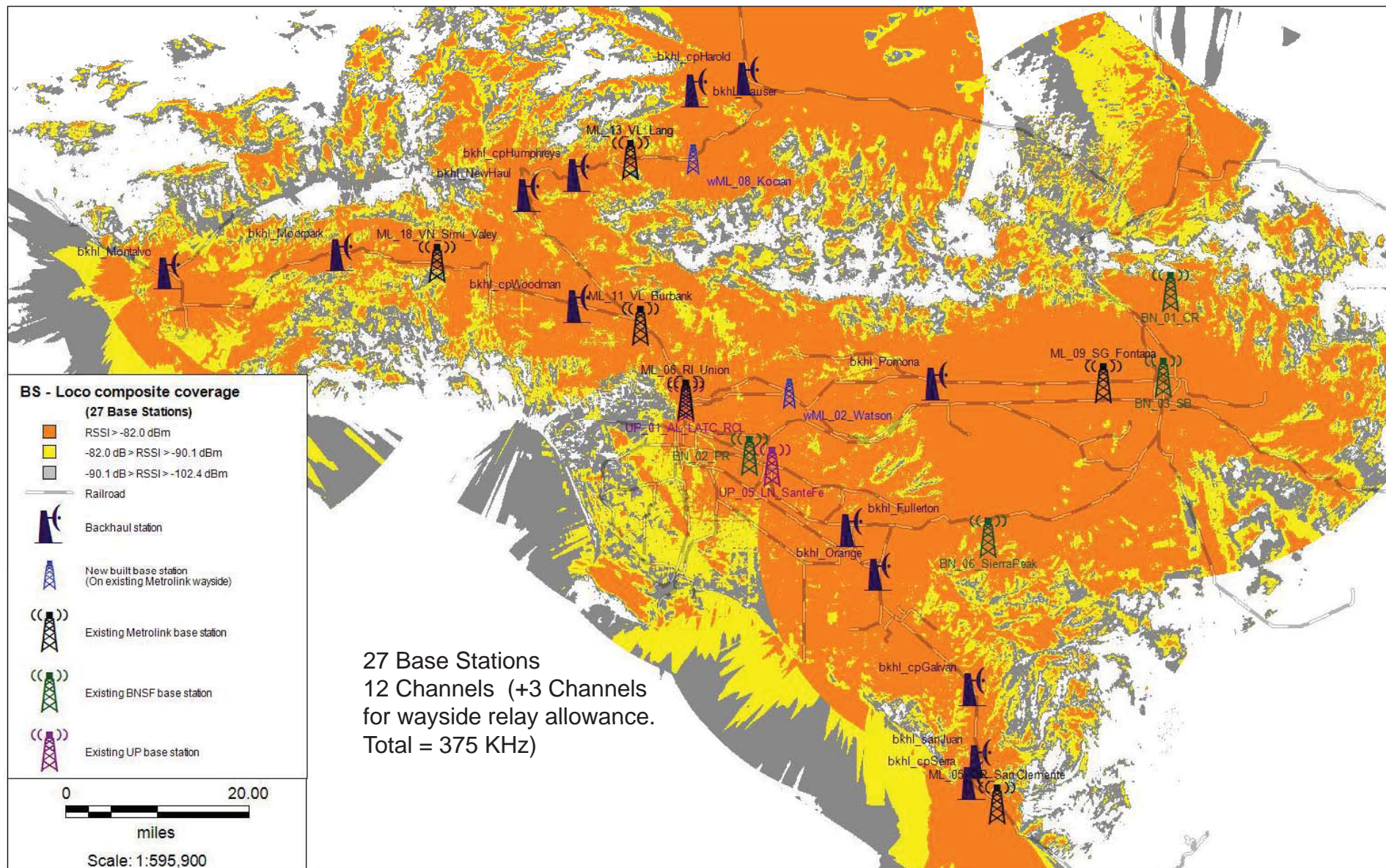
Soup to nuts Implementation of Untested PTC
Technology in a Difficult area

Spectrum Needs Analysis- LA Basin

Enough spectrum is needed to support:

- Full primary coverage of specified design area
 - Minimum required signal strength (from link budgets)
 - Minimum required signal-to-interference ratio
 - Capacity to handle offered load
- Coverage redundancy where needed
- A Frequency Re-Use Plan
 - Minimize Frequencies Required
 - Limit Co-Channel Interference
- Contingency for inaccuracies in modeling
- Flexibility to deal with interference and other channel anomalies
- Anticipated growth

Parsons Full Redundancy Design for LA Area



Change Management

What is Change Management?

From the BNSF Change Management Users Manual:

*It is the process that the BNSF Railway utilizes to manage various railroad assets. A **strong Change Management Process** is a critical necessity for the railroad's real-time authority compliance/collision avoidance systems*

I-ETMS requires a Safety Critical Database

Configuration Management

What is Configuration Management?

- Configuration Management (CM), is a process to **maintain the consistency and integrity of a system or software product throughout it's lifecycle**
- Configuration Management establishes the baseline control of changes made to a product's hardware, software and/or documentation

Full Time Network Manager and Database Manager
in addition to Document Control Manager on the
Project

Project Risk

- Project definition- **Still being defined**
 - Implementation- prescribed by Class Is-
 - Warranty and Maintenance
- Timeline/schedule aggressive- **Now Mid 2013**
 - Technology still being developed
 - Every railroad installing at the same time
- Technology- **Still being developed**
 - Interoperability
 - Communications-220 MHz, coverage, bandwidth, throughput
 - Marketplace constraints- limited suppliers and systems integrators
 - Data Radio- unproven- **Not available until 4/2012?**
 - Acquire Spectrum- **Caught up in FCC protest**
- Procurement
 - Limited number of vendors- **Beginning to see delays due to resource limitations**
 - Future sole source procurements for replacement parts

Project Risk (cont'd)

- Operational
 - Book of rules may require modifications- require modifications
 - Regulatory Interface and approval- Potential impact
 - Training of all maintenance and operational personnel- Timing is an issue
 - Potential operational degradation (PTC could lessen throughput)
 - Maintenance of System
 - Configuration Management of Infrastructure Database- Key to testing and implementation and FRA approval
- Resource Requirements
 - Support and Training Requirements
 - Resources to manage implementation- Additional resources required
 - Simultaneous Industry-wide implementation- Constraining Implementation
- Contract
 - Scope and deliverables definition- Still being defined
 - Total \$\$ Value & Payment terms

Major external schedule impacts

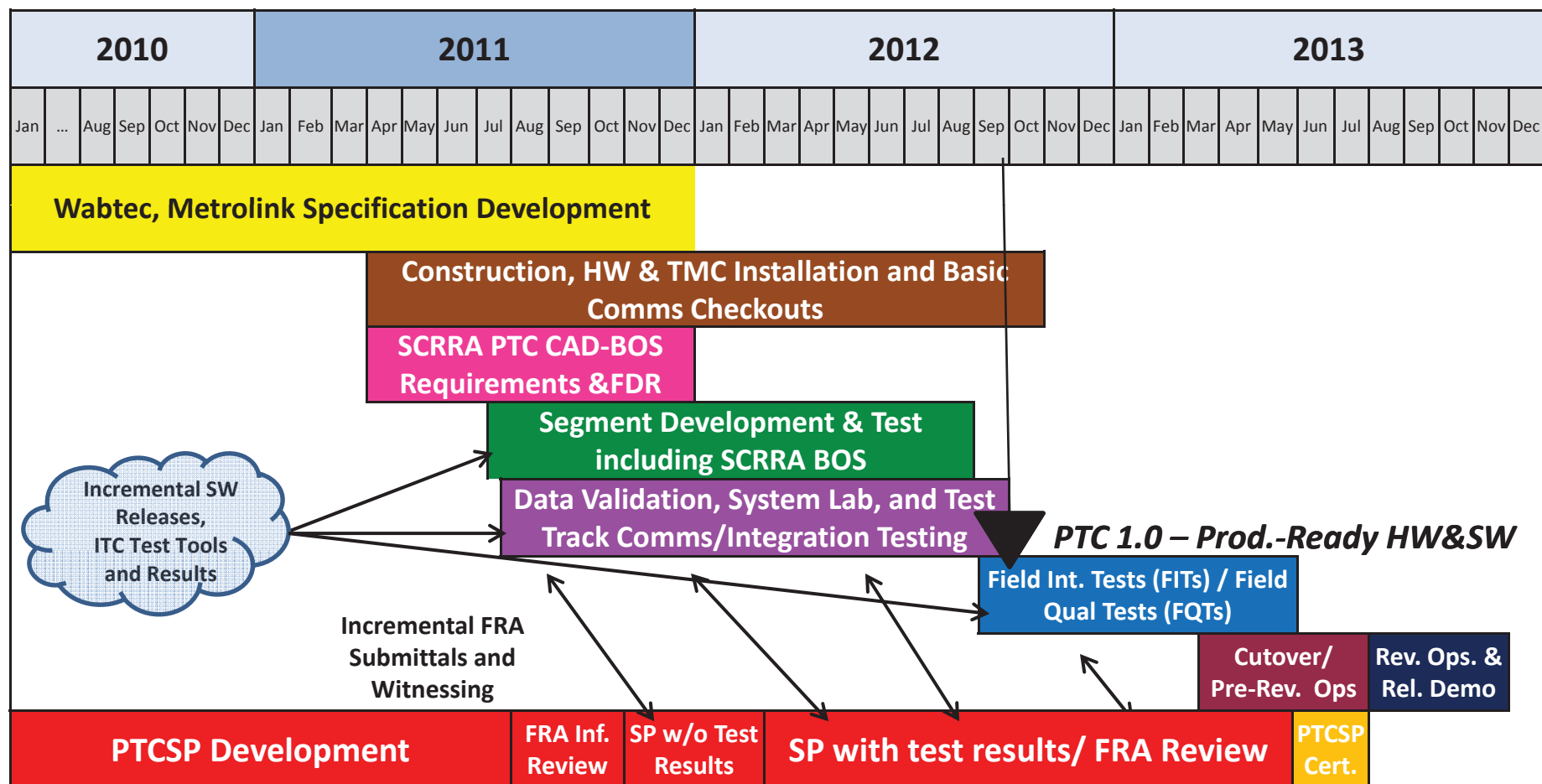
- Interoperable Train Control (ITC) Specifications need to be finalized in order to complete design of the BOS, On-Board System and CAD/BOS interface. **Delayed 9 months.**
- Meteorcom, a firm owned by the four ITC railroads is responsible for developing the PTC radios. **Currently approximately 1 year behind schedule.**
- PTC-220 LLC, an industry association similar to ITC is establishing the protocols for the communication network design and management. **Delayed 9 months.**
- Spectrum acquisition currently held up in court, needs FCC license granted. **Delayed in courts and FCC.**

PTC Schedule – Current (Slipped 6 months)

KEY ACTIVITY	START	FINISH	2011		2012				2013	
			Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
On-Board -Install/Test	10/6/11	10/11/12								
PTC Communications-Install/Test	10/24/11	8/25/12								
Wayside -Install/Test	7/25/11	7/20/12								
BOS -Install/Test	4/1/12	3/1/13								
CAD and then PTC CAD	11/5/10	2/1/13								
Early System Test (Incl BNSF ETMS 7)	11/7/11	10/1/12								
PTC 1.0- HW, SW, Test Plans Ready	10/1/12	10/1/12								
Field Integ. Tests/ Field Qual. Tests	9/1/12	5/31/13								
PTC Safety Plan Certification	2/1/13	6/1/13								
PTC Revenue Service	6/1/13	7/1/13								

Road Map Timeline

current master schedule submittal based on roadmap



Getting Agreements in Place !

Direct Parties to Agreements with Parsons and/or SCRRRA	Content/Type of Agreement							
	Memo Of Understanding	System Level Support	Subsystem/ Component Level Support	Other Services e.g. Training	Hardware	Software	Est. Months Lead Time	NEED BY DATE
ITC	?						6	Q3-2012
PTC 220	New Shared Use Agreement						9	Q3-2012
BNSF	Modified SUA						6	Q3-2012
UP	Modified SUA						6	Q3-2012
Amtrak	Modified SUA						6	Q3-2012
Parsons		Yes					12	Sys. Acceptance
Wabtec			Yes	Additional Services?	Yes	Yes	12	Sys. Acceptance
ARINC			Yes	Additional Services?	Yes	Yes	12	Sys. Acceptance
MeteorComm			Yes	Yes		Yes	12	PTC 1.0
Red Hat				Yes			9	
Radio OEM			Yes	Yes	Yes		9	
WMS OEM					Yes	Yes	6	
Cory's			Yes	Yes	Yes	Yes	6	Q3-2012

PTC Work Accomplished to Date

On- Board

- Pilots complete

Office

- CAD in testing
- BOS awaiting Class I railroad acceptance

Wayside

- Wayside Interface Unit install on schedule
- Antenna install on schedule

Communications

- Design Complete
- Base Station Construction Commencing

Lessons Learned

- Communications is the key but still in major development
- PTC Radios are still being developed- 2nd qtr. 2012
- Systems Integration must start from the beginning
- Document Control and Configuration and Change Management are essential
- Testing - begin with a lab environment then move to field
- Owner needs to be ready for the change
- Training must be comprehensive and timely
- Must partner with the tenant railroads
- Partner with the FRA to expedite reviews of Documentation

Partnering with the Owner is absolutely essential

QUESTIONS

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